ORIGINAL

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MODULATION METERS ME-57/U AND ME-57A/U

Headquarters, Department of the Army, Washington, DC
23 January 1985

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SECTION I

IDENTIFICATION AND DESCRIPTION

1. **Test Instrument Identification.** This bulletin provides instructions for the calibration of Modulation Meters ME-57/U and ME-57A/U. TM's 11-6625-400-12, 11-6625-400-35, and 11-6625-2629-14&P were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. None.

b. Time and Technique. The time

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required for this calibration is approximately 3 hours, using the dc and low frequency technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1. DA Form 2416 must be annotated in accordance with TB 750-25-1 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications	
Deviation range (kHz)	Modulating frequency range and accuracy (kHz)	
	50 Hz to 20 kHz	20 to 70 kHz
0 to 20	±0.75 kHz	±1.5 kHz
0 to 50	±2 kHz	±4 kHz
0 to 100	±5 kHz	±10 kHz
0 to 300	±15 kHz	±30 kHz
0 to 1000	±100 kHz	±100 kHz
Modulating frequencies	50 Hz to 20 kHz with carrier frequencies of 20 to 100 MHz 250 Hz to 70 kHz with carrier frequencies of 100 MHz to 1 GHz	
Input sensitivity	0.005 V required for limiting	
Carrier shift accuracy	±10% of indicated value	
Audio output	1 V rms corresponding to 40 kHz deviation on 0 to 50 kHz range	
RF oscillator	Range: 20 to 1000 MHz Accuracy: ±10%	

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SECTION II

EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-287. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name	Minimum use specifications	Manufacturer and model (part number)
A1	ATTENUATOR	Range: 0 to 120 dB	Hewlett-Packard, Model 355D (355D)
A2	AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	General Radio, Model W10MT3AS3 or Ridge, Model 9020F (7910809)
A3	DIGITAL VOLTMETER	Range: 189 to 201 V dc Accuracy: ±0.75%	Hewlett-Packard, Model 3490AOPT060 (3490AOPT060)
A4	MODULATION ANALYZER	Frequency range: 50 to 750 MHz Accuracy: ±0.0025% Deviation: 20 to 300 kHz Accuracy: ±1% of reading ±1 digit	Hewlett-Packard, Model 8901 (8901)
A5	MULTIMETER	Range: 2 V rms Accuracy: ±3%	Hewlett-Packard, Model 410C (7910902)
A6	SIGNAL GENERATOR	Deviation: 14.25 to 900 kHz at carrier frequency from 50 to 900 MHz Accuracy: ±1% Range: Output of 100,000 µV; 600 kHz deviation	Hewlett-Packard, Model 8640BOPTH66 (MIS-28707 Type 1) w/model 10515A (10515A)

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Table 3. Accessories Required

Item	Common name (official nomenclature)	Description (part number)
B1	ADAPTER	N T-type, 2 jacks, 1 plug (7907472)
B2	ADAPTER[1]	N plug to BNC jack (10519457)(UG201A/U)
B3	ADAPTER[2]	BNC plug to N jack (10519458)(UG349A/U)
B4	CABLE[1]	18-in., RG-9A/U; N plug terminations (10519072)
B5	CABLE	30-in., RG-58/U; BNC plug terminations (7907467)
B6	CABLE	30-in., RG-58/U; double banana plug terminations (7907470)
B7	PROBE (TEST LEAD)	30-in., RG-58/U; double banana plug to probe and alligator clip (7911305)

[1]Two required.

[2]Three required.

SECTION III

CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in TM's 11-6625-400-12, 11-6625-400-35, and 11-6625-2629-14&P for this TI.

NOTE

When indications specified in paragraphs 8 through 12 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs 8 through 12. Do not perform power supply check if all other parameters are within tolerance.

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NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

a. Remove TI protective cover.

b. Connect TI to autotransformer (A2).

c. Connect autotransformer to a 115-V ac source and adjust controls for a 115-V ac output.

d. Energize equipment and allow 30 minutes for warmup and stabilization.

8. RF Oscillator Accuracy

a. Performance Check

(1) Position controls as listed in (a) through (d) below:

(a) TUNE-FINE TUNE switch to TUNE.

(b) FREQUENCY RANGE-MC switch to 20-55.

(c) FREQUENCY-MC dial to 20.

(d) DEVIATION RANGE-C switch to 1000 TUNE.

(2) Connect signal generator (A6) to TI input, using cable and adapter (B5 and B2).

(3) Adjust signal generator for an initial 20-MHz signal output at 5 mV amplitude.

(4) Fine tune signal generator for a 0 indication on CARRIER SHIFT meter and a black line indication on LIMITING meter. Signal generator final indication will be between 18.00 and 22.00 MHz.

NOTE

If TI interference is encountered during this check, momentarily disconnect TI, verify generated frequency on frequency counter, and reconnect TI.

(5) Repeat technique of (3) and (4) above, using settings listed in table 4. If signal generator does not indicate within limits specified, perform b below.

b. Adjustments

(1) Set FREQUENCY RANGE-MC switch to 20-55.

(2) Adjust signal generator for a 35-MHz indication.

(3) Loosen setscrew that holds FREQUENCY-MC dial to oscillator shaft and adjust oscillator shaft for a 0 indication on CARRIER SHIFT meter.

(4) Adjust FREQUENCY-MC dial to 35 MHz and tighten setscrew.

(5) Repeat a above.

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Table 4. RF Oscillator

Test instrument		Signal generator		
FREQUENCY RANGE-MC switch settings	FREQUENCY-MC dial settings	Initial settings (MHz)	Final indications (MHz)	
			Min	Max
20-55	35	35	31.5	38.5
20-55	50	50	45	55
55-120	60	60	54	66
55-120	87.5	87.5	78.75	96.25
55-120	115	115	103.5	126.5
120-250	130	130	117	143
120-250	185	185	166.5	203.5
120-250	240	240	216	264
250-500	260	260	234	286
250-500	375	375	337.5	412.5
250-500	475	475	427.5	522.5
500-1000[1]	550	550	495	605
500-1000	750	750	675	825
500-1000	950	950	855	1045

[1]Use frequency multiplier.

9. Input Sensitivity

a. Performance Check

(1) Set FREQUENCY RANGE-MC switch to 250-500 and adjust FREQUENCY-MC dial to 400.

(2) Adjust signal generator (A6) for a 400-MHz CW signal output at 5 mV amplitude.

(3) Adjust TUNING control for maximum indication on LIMITING meter while maintaining 5-mV amplitude. If LIMITING meter pointer is not within the black area, perform **b** below.

b. Adjustments. Adjust LIMITING ADJ R51 (fig. 1) until TI LIMITING meter pointer is at beginning edge of black area (R).

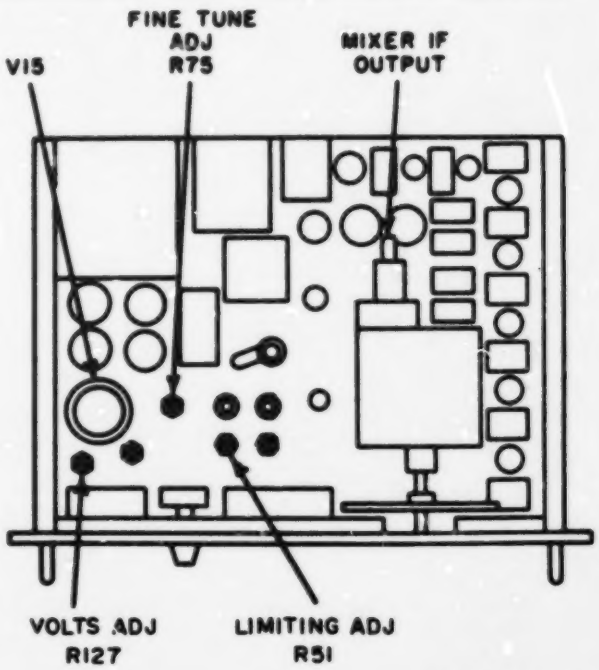

Figure 1. Modulation meter - top view.

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10. Carrier Shift

a. Performance Check

(1) Set FREQUENCY RANGE-MC switch to 20-55 and adjust FREQUENCY-MC dial to 50.

(2) Adjust signal generator (A6) for a 50-MHz CW signal at 100 mV amplitude.

(3) Adjust TUNING control for a 0 indication on CARRIER SHIFT meter.

(4) Set TUNE-FINE TUNE switch to FINE TUNE and adjust TUNING control for a 0 indication on CARRIER SHIFT meter. Record signal generator indication.

(5) Adjust signal generator frequency for a negative 250-kHz shift on CARRIER SHIFT meter. Record signal generator indication.

(6) Subtract lower from higher frequency value recorded in (4) and (5) above. If difference is not between 225 and 275 kHz, perform b below.

(7) Adjust signal generator frequency for positive 250-kHz shift on CARRIER SHIFT meter and subtract frequency counter indication from value recorded in (4) above. If difference is not between 225 and 275 kHz, perform b below.

b. Adjustments

(1) Adjust signal generator for an indication of 250 kHz above value recorded in a(4) above.

(2) Adjust FINE TUNE ADJ R75 (fig. 1) until CARRIER SHIFT meter indicates a negative shift of 250 kHz (R).

NOTE

If positive and negative shift are both high, adjustment of R75 alone will not correct out-of-tolerance condition. Refer to TM 11-6625-2629-14&P for realinement procedures.

(3) Adjust signal generator for an indication of 250 kHz below value recorded in a(4) above.

(4) Adjust FINE TUNE ADJ R75 until TI CARRIER SHIFT meter indicates a positive shift of 250 kHz (R).

(5) Repeat (1) through (4) above until no further adjustment is required.

11. Frequency Deviation

a. Performance Check

(1) Connect equipment as shown in figure 2.

NOTE

Momentarily disconnect TI to verify frequency on modulation analyzer. Reconnect TI.

(2) Position controls as listed in (a) and (b) below:

(a) DEVIATION RANGE - KC switch to 20.

(b) FREQUENCY RANGE - MC switch to 20-55.

(3) Set modulation analyzer (A4) for AUTOMATIC OPERATION to measure FREQ.

(4) Adjust signal generator (A6) for a 50-MHz CW output on modulation analyzer and adjust attenuator (A1) as necessary to limit signal to black sector of TI limiting meter.

(5) Adjust TI FREQUENCY-MC dial for a 0 indication on CARRIER SHIFT meter.

(6) Set signal generator FM switch to INT and MODULATION FREQUENCY control for 1 kHz.

(7) Set modulation analyzer MEASUREMENT switch to FM.

(8) Adjust signal generator PEAK DEVIATION control for a 20-kHz full scale indication on TI. If DEVIATICN meter does not indicate full scale when modulation analyzer indicates between 19.25 and 20.75 kHz deviation, perform b below.

(9) Repeat technique of (2) through (8) above for control settings and indications listed in table 5. If modulation analyzer does not indicate within limits specified, perform b below.

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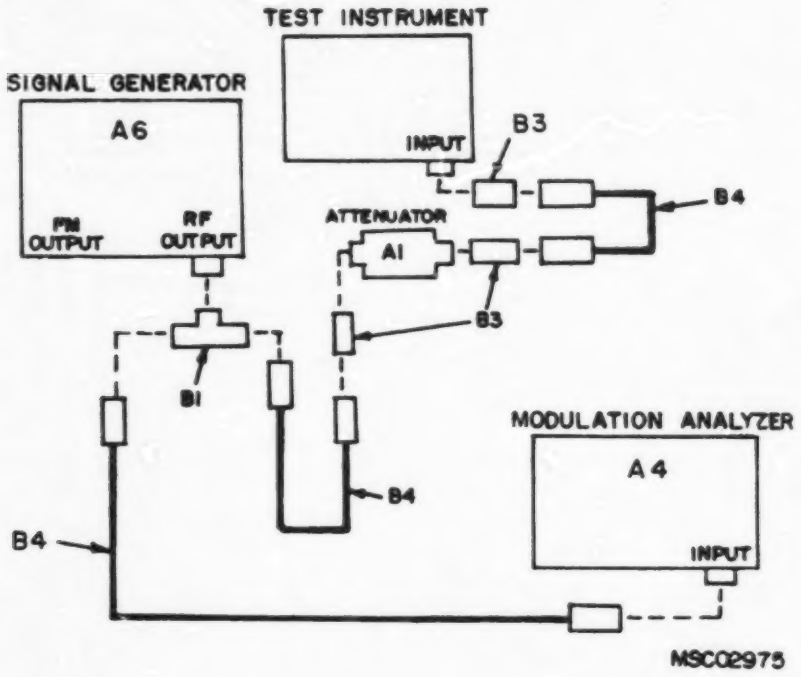

Figure 2. Frequency deviation - equipment setup.

Table 5. Frequency Deviation

Test instrument				Signal generator		MODULATION ANALYZER indications (kHz)	
FREQUENCY RANGE-MC switch settings	FREQUENCY MC dial settings	DEVIATION RANGE-KC switch settings	DEVIATION meter indications (kHz)	Carrier FREQUENCY (MHz)	MODULATION FREQUENCY (kHz)	Min	Max
55-120	100	50	50	100	1	48	52
120-250	200	100	100	200	1	95	105
250-500	400	300	300	400	1	285	315
500-1000	750	300	300[1]	750	1	285	315

[1]Deviation limitation of modulation analyzer (A4).

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b. Adjustments

(1) Set FREQUENCY RANGE-MC switch to 55-120 and DEVIATION RANGE-KC switch to 50.

(2) Adjust signal generator for a 100-MHz CW output.

(3) Adjust FREQUENCY-MC dial for a 0 indication on TI CARRIER SHIFT meter.

(4) Adjust signal generator MODULATION FREQUENCY control for a 9.0-kHz indication on frequency counter.

(5) Adjust signal generator PEAK DEVIATION control for a 50-kHz deviation indication on modulation analyzer.

(6) Adjust CAL ADJUST (front panel) for a 50-kHz indication on TI DEVIATION meter (R).

(7) Repeat a above.

12. Audio Output

a. Performance Check

(1) Connect multimeter (A5) to AUDIO OUTPUT, using cable (B6).

(2) Set DEVIATION RANGE-KC switch to 50 and FREQUENCY RANGE-MC switch to 20-55.

(3) Adjust signal generator (A6) for a carrier frequency of 50 MHz and modulation frequency of 20 kHz. If multimeter does not indicate 1 V rms with DEVIATION meter indication of 40, perform **b** below.

b. Adjustments. Adjust AUDIO ADJ (front panel) for a 1-V rms indication on multimeter (R).

13. Power Supply

NOTE

Do not perform power supply check if all other parameters are within tolerance.

a. Performance Check. Connect digital voltmeter (A3) between pin 6 of V15 (fig. 1) and chassis ground, using probe (B7). If digital voltmeter does not indicate between 189.15 and 200.85 V dc, perform **b** below.

b. Adjustments. Adjust VOLTS ADJ R127 (fig. 1) for a 195-V dc indication on digital voltmeter (R).

14. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25-1.

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